# Entrepreneurship Education at the Dawn of Generative Artificial Intelligence

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## Abstract
The rapid evolution, application and ubiquity of generative artificial intelligence (AI) tools seems to be indicative that our world has entered a paradigm shift that mirrors the beginning of a new era not seen since the dawn of the internet. As entrepreneurship educators, we are pushed to the frontline of this development, mandated to embrace this transformative innovation to not only educate our students but also use its potential to reshape our classrooms. To help better understand this paradigm shift, this editorial invites the larger entrepreneurship education community to innovate, experiment, and learn in order to advance our theoretical and practical understanding of generative AI's present and future impact on our field. Furthermore, it presents a series of inquiry questions to help guide our community to advance our field through rigorous research and impactful learning innovations.

## Keywords
artificial intelligence, entrepreneurship, entrepreneurship education, ChatGPT

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In November 2022, OpenAI, a San Francisco-based lab that develops artificial intelligence (AI) technologies, released a powerful conversational chatbot called ChatGPT for public use (OpenAI, 2022). It became the most rapidly adopted consumer product in history (Hu, 2023), with its website registering 1.8 billion visits in April 2023 (Nerdynav, 2023). Its imMarco pact on early adopters' performance was immediately apparent, with Microsoft, OpenAI's chief funder, reporting a significant increase in their Bing search engine visits in February 2023 after integrating ChatGPT capabilities (Carr, 2023).

The global adoption of ChatGPT has demonstrated a wide range of uses for the technology, from information acquisition and software development and testing, to writing poetry and generating ideas for birthday parties. ChatGPT is but one example of generative AI-based products with new capabilities emerging weekly (Wardini, 2023). While ChatGPT is a general-purpose chatbot, many AI tools are directed at research and education in a more specialized manner. Researchers and students can make use of readily available tools to facilitate scholarly tasks, including searching and mapping articles (e.g., Research Rabbit, VosViewer and Elicit), summarizing and understanding those articles (e.g., Scholarcy, SciSpace), analyzing data (e.g., RTutor), academic writing assistance (e.g., Grammarly, Magic Write, Writefull), and even presenting their work in a more vivid manner (e.g., Midjourney, DALL-E). In education, students discovered that ChatGPT and its extensions can be quite helpful with essays and other assignments, while their teachers started using it in lectures and exam preparations. Educators and administrators also started sounding the alarm bells, noting the potential of these tools to be used by their students to avoid learning and to submit work generated by AI as their own.

While the mass-scale use of AI tools by consumers is a novel phenomenon, many businesses already use AI tools by integrating them, for example with their websites and social media channels to offer personalized customer support. Several companies even built or upgraded their commercial AI products for different industries and use cases, following GPT-3 release (Bhattacharyya, 2022). Big tech leaders such as Google, Microsoft and Meta integrate AI tools into their products and services (Reuters, 2023), highlighting how the flood of novel AI technologies and applications (Wardini, 2023) is transforming the business sector.

The rapid evolution, application and ubiquity of AI tools show how individuals, companies, and industries experiment with AI tools for different purposes, eyeing their promised benefits (Berg et al., 2023). It seems our world has entered a paradigm shift that mirrors the beginning of a new era not seen since the dawn of the internet. As entrepreneurship educators, we are pushed to the frontline of this development, mandated to embrace this transformative innovation to not only educate our students but also use its potential to reshape our classrooms. Neither banning nor uncritically adopting generative AI tools will help us maximize their benefits while minimizing their downsides. Instead, we must increase our experience and leverage our conceptual capabilities to advance our understanding.

Entrepreneurship Education and Pedagogy (EE&P) is "tasked to bridge the gap between our understanding of [entrepreneurship education] with regard to what we

teach (content), how we teach (methods), who we teach (audience), and for what purpose (impact)" (Liguori et al., 2018, p. 6). We therefore believe that EE&P must play an essential role in shaping our understanding of how the present paradigm shift brought on by generative AI will impact varied aspects of entrepreneurship, education, and research. To this end, this editorial:

- Invites the larger entrepreneurship education community to innovate, experiment, and learn in order to advance our theoretical and practical understanding of generative AI's present and future impact on our field.
- Presents a series of inquiry questions to help guide our community to advance our field through rigorous research and impactful learning innovations.

## Generative AI Overview

Generative AI, the latest breakthrough in AI, machine learning and big data, can perform a vast variety of natural language processing (NLP) tasks. It refers to a class of AI that focuses on generating new data or content that fits a given dataset's probability distribution. Unlike other areas of AI research that focus on classification or prediction, generative AI aims to create new outputs based on learning the underlying patterns and structures within observed data. Data leveraged in the training of generative AI models may include text (such as ChatGPT-4), images, audio files, video files, or multi-modal files, which then generate corresponding outputs. Much of the excitement about generative AI stems from the fact that an estimated 80% of the world's data is unstructured, not fitting into rows and columns in spreadsheets (Harbert, 2021). Thus, generative AI represents an explosion of data use and human creativity in exploiting available data.

Recent dramatic advances in generative AI have stemmed from the pairing of deep multi-layered neural networks, also known as deep learning, and massive-scale data sets. These paired breakthroughs, combined with the transformer architecture (Vaswani et al., 2017), have enabled companies such as Google, Meta, and OpenAI to build massively capable foundational Large Language Models (LLMs) with the ability to interact conversationally on a shocking range of topics.

ChatGPT-4, OpenAI's most recent model, has 175 billion parameters, or individual weights in the neural network, capturing patterns and structures across a vast trove of text sources (OpenAI, 2023). The model was trained on an expansive range of undisclosed datasets, including websites, books and other text, allowing it to understand and generate human-like text across a wide range of subjects. ChatGPT-4 can understand and generate text in multiple languages, making it useful to a global audience. A so-called foundational model, ChatGPT-4 can be fine-tuned to specific tasks or industries. Indeed, companies in nearly all industries are exploring the value-creation potential of ChatGPT-4. Increasingly, ChatGPT has been leveraged in educational settings, assisting in creating instructional materials, aiding researchers in information synthesis and analysis, and providing personalized tutoring in various subjects. While

some view AI as an existential threat to critical thinking, other prominent educators argue generative AI may be able to dramatically improve learning outcomes (TED, 2023).

OpenAI (ChatGPT), Google (Bard), and Anthropic (Claude) have all put measures in place to prevent malicious use and to mitigate biases in their models, although challenges remain in ensuring that the technology is used responsibly. The value of the generative output from large language models itself is a topic of debate, with some researchers arguing that LLMs are in fact a deceptive, or even potentially dangerous risk given the model's ability to put forth an illusion of insight, sentience and understanding where no actual model of the world exists (Bender et al., 2021; Chomsky et al., 2023). These risks are with the users themselves, who may impute human-type cognition and understanding in working collaboratively with AI models.

## Generative AI and Entrepreneurship Education Research and Practice

To help advance our field through research and practice in entrepreneurship education, we introduce a contextual framework to guide entrepreneurship educators, researchers, and practitioners to better understand the emerging generative AI landscape in entrepreneurship education (see Figure 1). The framework highlights that work in the Research and Learning Innovation sections of Entrepreneurship Education & Pedagogy operates at the intersection of entrepreneurship, research and education. All three are impacted by generative AI, which affects the domain itself, how we research the domain, and how we learn and master the domain. Regarding entrepreneurship as a practice, generative AI tools can be applied in any functional business domain (e.g., Marketing, Finance, Operations, HRM), and offer benefits at each phase of the entrepreneurial process (generating ideas for opportunities, gathering and assessing resources, launching, growing and exiting the venture). Generative AI tools can be involved in all phases of the research process (research design, data collection, data analysis, and - particularly - reporting). Finally, generative AI tools affect educational practices in terms of learning processes and the assessment of outcomes. Teachers and students must adjust to the new reality of teaching and learning in which each will have (a family of) digital assistants. As such, the framework shows the complexity as well as the scope of how generative AI will affect our journal's domain, which operates at the intersection of three moving targets.

To help our community engage with incorporating generative AI tools in our learning innovations and studying the opportunities and challenges of generative AI for our field in our research designs, the following section offers several questions organized across lines of inquiry in the areas of entrepreneurship, research, and education. These questions are a result of several rounds of brainstorming and discussion among the authors, supported by ChatGPT, informed by selected literature (notably, Dwivedi et al., 2023).
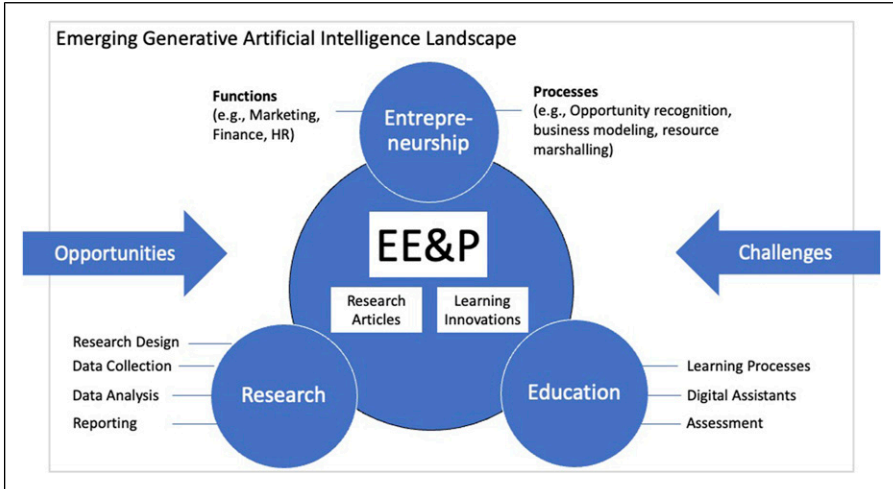
**Figure 1.** Context of generative AI in entrepreneurship education.

## Generative AI and Entrepreneurship

Generative AI is reshaping entrepreneurship functions (e.g., marketing finance, HR) as well as core processes (e.g., opportunity recognition, business modeling, resource marshaling). AI technologies such as ChatGPT can help firms and startups add revenues, differentiate products and services, reduce costs, optimize risks, innovate offerings and transform their societies, as conceptualized in Mithas' ADROIT framework (Dwivedi et al., 2023). Hence, in their (future) work lives, entrepreneurs and entrepreneurship students alike will want to use the latest AI technologies on the market. Entrepreneurial practice is the ultimate determinant as well as the focus of entrepreneurship education research and learning. We propose the following questions to inform our lines of inquiry within the larger entrepreneurship domain, which, for the purposes of our journal, need to be related to the aims and purpose of EE&P.

1. How will entrepreneurs exploit generative AI as a transformative technology to create new value? What new types of entrepreneurial opportunities will emerge and/or be created?
2. How are entrepreneurial behavior and cognition evolving due to the availability and use of emergent AI tools?
3. Where and in what ways might generative AI reshape core entrepreneurial functions (e.g., marketing finance, HR) and processes (e.g., opportunity recognition, business modeling, resource marshaling)?

4.  When is AI more suitable to take more simple roles in entrepreneurial teams, such as research assistant and text editor; and when more sophisticated roles, such as innovator and product developer? (Dwivedi et al., 2023).

## Generative AI and Entrepreneurship Research

With the emergence of generative AI, we call for new lines of inquiry and explorations of theoretical and methodological horizons. This may require bold approaches to address research and practice gaps, given the present paradigm shift, and which may challenge our current understanding of entrepreneurship. It also concerns the research process itself, as generative AI technology can be expected to increasingly affect all stages of the scientific process (Van Dis et al., 2023). We propose the following inquiry questions to guide our conversation:

5.  How will generative AI enable new horizons in entrepreneurship research and in entrepreneurship education research specifically?
6.  What existing theories can inform the study of generative AI in entrepreneurship, and where is theory development needed to address critical gaps?
7.  How can generative AI facilitate the examination of new measures and constructs in entrepreneurship research, including new ways to interrogate, relate and visualize entrepreneurship phenomena?
8.  How will generative AI influence entrepreneurship education research projects and collaborations, including task distribution, data acquisition and analysis, and writing?

## Generative AI and Entrepreneurship Education

Generative AI is conceptualized to have several benefits towards improving learning outcomes, increasing the efficiency of the educational process, and supporting a student-centered approach. It can help improve essential entrepreneurial skills such as critical thinking, self-reflection, and knowledge application among students. On the educator side, it can help with material preparation, designing assignments and suggesting experiential activities. The speed and efficiency of AI tools allow educators to develop teaching formats and materials that were previously too time-consuming to produce (Mollick & Mollick, 2022). At the same time, it is feared that AI tools can facilitate cheating and plagiarism, diminish students' cognitive abilities, and substitute for learning and lecturers (Kasneci et al., 2023; Terwiesch, 2023). Given the complexities of the potential impact on our field, we offer several inquiry questions, ranging from *general questions* to *best practices and applications*; *drivers and policies;* and ethical challenges regarding *accountability, bias, diversity and inclusion, privacy and security.*

*General Questions.* Generative AI will require entrepreneurship trainers and educators to re-evaluate their teaching practices and perhaps consider novel ones. Generative AI will enable neoteric ways of learning in formal and informal settings as (budding) entrepreneurs will be able to call on a range of AI-enabled digital assistants. Some questions to inform our lines of inquiry within the larger entrepreneurship education domain are as follows:

9. How are emergent generative AI tools supporting and challenging past and present teaching paradigms in entrepreneurship education, including the role of the educator and the student?
10. How can generative AI support the work of entrepreneurship educators in the preparation, delivery, and assessment of entrepreneurship courses?
11. How will generative AI impact entrepreneurial learning in informal settings?
12. How does the use of generative AI in entrepreneurship education compare to traditional teaching methods in terms of effectiveness and efficiency?
13. How will entrepreneurship education (re-)prioritize students' skills when leveraging this new teaching paradigm across different educational levels?
14. Do generative AI tools independently generate novelty (in terms of entrepreneurship, education, and/or research), or does it merely regurgitate – or something in between ("regurgenerate", Dwivedi et al., 2023)?
15. How can entrepreneurship educators stay abreast of rapidly evolving developments in generative AI and AI more generally?

*Best Practices and Applications.* Ultimately, the learning innovation section of EE&P aims to present impactful novel approaches to teaching and learning entrepreneurship and we expect generative AI to spur a range of pedagogical innovations in the upcoming years. At the same time possible challenges and limitations must be acknowledged and addressed. Generative AI has the potential to promote and deteriorate students' learning skills more generally, particularly their creative, critical thinking, and writing skills. The following questions may help create learning innovations that generate positive economic, cultural, social and ecological value.

16. How can entrepreneurship educators leverage generative AI to design powerful, new learning experiences for students?
17. How can entrepreneurship educators use generative AI to provide learning experiences specific to individual learners or particular groups of learners (e.g., neurodiverse)?
18. What skills, resources, and capabilities are needed to handle generative AI in the context of entrepreneurship education?
19. How can we assess the effectiveness of generative AI tools in terms of student learning and performance processes?

20. How can generative AI technologies be utilized to foster the engagement of entrepreneurship students in online, offline, and hybrid learning environments?
21. How might generative AI in educational settings augment human creativity and group creativity in the context of entrepreneurial value creation?
22. How can generative AI support the development and refinement of entrepreneurial ideas in entrepreneurship courses and programs through rapid prototyping and testing?
23. What theoretical frameworks and practical tools can help to address and mitigate risks associated with misuse, plagiarism, and distortion in AI-enhanced entrepreneurship education?
24. How to prevent the use of AI tools from limiting the development and application of entrepreneurship students' creativity, independent thinking and language expression skills?
25. How can entrepreneurship educators prevent the use of AI tools for creating unproductive or destructive forms of entrepreneurship?

*Drivers and Policies.* Entrepreneurship training and courses are typically embedded in a broader institutional context. The use and adoption of generative AI for student learning and assessment need to be supported by policies and frameworks that are helpful to teachers and students and promote innovation adoption.

26. What are the drivers of generative AI adoption for innovation (economic, technological, and social) and education?
27. What programmatic and course policies promote the innovative and ethical use of AI in entrepreneurship education?
28. What frameworks can guide experimentation with generative AI in entrepreneurship education?

*Accountability, Bias, Diversity and Inclusion, Privacy and Security.* Many authors have pointed out that the use of generative AI raises ethical issues of accountability, bias, and diversity and inclusion (Dwivedi et al., 2023). Some AI tools are currently unable to show the sources and underlying logic producing their output. Moreover, tech companies that release AI tools are reluctant or unwilling to reveal their algorithms in order to maintain their competitive advantage.

Moreover, the information that AI algorithms use to predict words and sentences may itself contain biases, even if unwittingly, which are then reproduced in generative AI's output (Akter et al., 2021; Levy & Liguori, 2023). Issues of diversity and inclusion not only relate to the data used by generative AI but also to having access to the best possible tools. This will particularly become a concern when the paid and free versions diverge sharply in terms of the benefits they offer and how these benefits may impact certain groups and demographics differentially. Finally, significant questions have also emerged about data privacy and security.

29. What ethical questions does the application of generative AI to entrepreneurship and entrepreneurship education raise?
30. What are the theoretical considerations around the ethical use, accountability, and potential bias of generative AI in entrepreneurship education?
31. How can we ensure that systemic bias and inequities will not be further perpetuated with the application of AI in entrepreneurship education?
32. How can AI potentially support more equitable entrepreneurship education?
33. Will generative AI "democratize" entrepreneurship education and its availability, or will it heighten inequality and access to technology?
34. What (theoretical) approaches can be used to ensure AI promotes diversity, equity and inclusion in entrepreneurship education?
35. What theory and practical measures can guide the development of robust measures to protect student data privacy and security in AI-integrated entrepreneurship education?

## Conclusion

Generative AI brings promising new opportunities to support idea generation and concept development, market and customer insight gathering, and the rapid prototyping of entrepreneurial ideas. Moreover, the computational capabilities and knowledge resourcefulness of AI applications will also have important implications for entrepreneurial learning given the high level of uncertainty and complexity that characterize entrepreneurial realities (Fayolle, 2018; Neck & Greene, 2011). Still, many questions remain. This editorial is intended as a guide to help us navigate the frontiers of the new developments in generative AI during this unprecedented paradigm shift in entrepreneurship and entrepreneurship education. EE&P is looking forward to publishing research articles and learning innovations in this space. Therefore, we call for our community of entrepreneurship scholars, educators, and practitioners to push our field forward by exploring, trying (and failing), and investigating this new "humanized" technology. We hope our framework and associated inquiry questions will support and advance exciting lines of inquiry and facilitate a larger conversation about opportunities and challenges presented by advances in generative AI that were previously inconceivable.

### Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

## Funding

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